DRISI

Caltrans Division of Research, Innovation and System Information

Research Results

Evaluation of Open-Graded Friction Course Mix Designs

Recommending changes to open-graded mix designs to improve longevity

Pavement

DECEMBER 2013

Project Title:
Laboratory Evaluation of Thin and Modified Asphalt Overlay Mix Design Procedures

Task Number: 1874

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Product Category: Improved business practice and procedure

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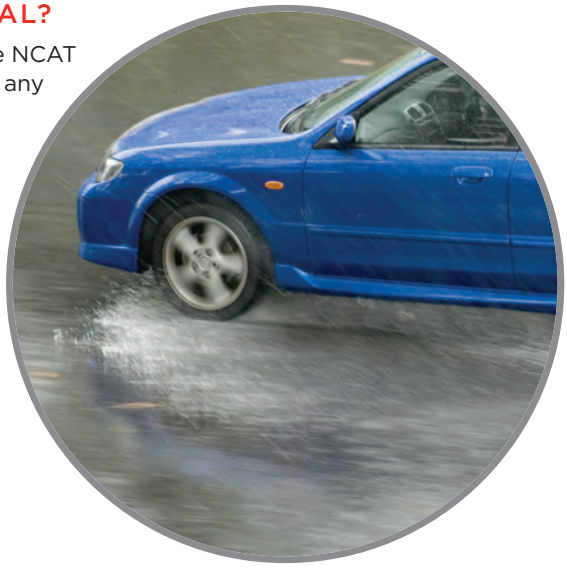
WHAT WAS THE NEED?

Open-graded friction courses (OGFCs) improve skid resistance, particularly in wet weather, and reduce tire and pavement noise. The OGFC mix, which is applied as a thin layer on the pavement surface, increases the friction and permeability of the road. The higher permeability allows water to drain into and away from the surface quickly, reducing the dangers of spraying, splashing, and hydroplaning during wet weather and improving the friction. In addition, the higher permeability absorbs sound, making OGFCs a good choice for noise-sensitive areas.

OGFCs consist of a single size of coarse aggregate, a small portion of fine aggregate, high asphalt binder content, and a large percentage of air voids. This structure makes OGFCs more prone to raveling. The longevity of OGFCs depend on a number of factors, such as traffic, climate, construction quality, and mix design. The goal of a mix design is to determine the optimum mixture gradation, binder content, compaction, and air voids. To improve the longevity of OGFCs, the National Center for Asphalt Technology (NCAT) proposed a comprehensive approach for OGFC mix design.

WHAT WAS OUR GOAL?

The goal was to evaluate the NCAT mix design method, identify any problems, and recommend improvements.



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WHAT DID WE DO?

Caltrans, in partnership with the University of California Pavement Research Center (UCPRC), performed laboratory tests based on the NCAT mix design method using different asphalt binders and aggregates. The researchers selected three asphalt binders, two from a refinery in Bakersfield, and one from a refinery in Modesto, and three aggregate samples with different properties from northern, central, and southern California—Sacramento, Watsonville, and San Gabriel, respectively. The team evaluated the mix design method with regards to:

- Optimum gradation
- Optimum binder content
- Compaction of laboratory specimens
- Asphalt absorption
- Draindown and durability
  (Draindown is when asphalt binder runs off the aggregate after mixing while it is still hot and temporarily stored or being transported to the construction site.)

The researchers used the results of the laboratory tests to recommend improvements to the NCAT's mix design approach.

WHAT WAS THE OUTCOME?

The NCAT OGFC mix design is a rational method but had shortcomings in terms of selecting the optimum gradation. The researchers proposed revised procedures to improve the mix design and suggested that OGFC compaction be controlled by the specimen height rather than by the number of gyrations. It was found that it is not necessary to specify the upper limit of the air-void content if a compacted mix can meet the performance specifications for permeability, durability, and moisture sensitivity. The results also indicated that binder type and grade selection are important to balance draindown and durability.

WHAT IS THE BENEFIT?

Open-graded mixes improve skid resistance and reduce pavement noise. However, the mix design method being used had some shortcomings that could reduce longevity. The NCAT approach enhances the performance, providing longer lasting open-graded friction courses.

LEARN MORE

For more information about OGFC:
www.dot.ca.gov/hq/maint/Pavement/Offices/Pavement_Engineering/Flexible_Pavement.html

Aggregate samples from northern (left), central (middle), and southern (right) California